

CLAIMS

I claim:

1. A D-peptide comprising a sequence of from three to seven D-amino acid residues, wherein at least two of the amino acid residues of the sequence are independently selected from the group consisting of D-tryptophan, D-tyrosine, and D-phenylalanine.
2. The D-peptide of claim 1, wherein the sequence comprises at least three amino acid residues independently selected from the group consisting of D-tryptophan, D-tyrosine, and D-phenylalanine.
3. A D-peptide comprising a pentapeptide sequence selected from the group consisting of Xaa₁YYFF, Xaa₁FYFF, Xaa₁YFFF, Xaa₁FFYF, Xaa₁YFFY, Xaa₁YFYF, Xaa₁FFFF, Xaa₁FYYF, FXaa₁FFF, YFXaa₁FF, Xaa₁FWXaa₂Y, Xaa₁FXaa₂WY, Xaa₁Xaa₂FFW, Xaa₁FFFY, FFFFXaa₁, YXaa₁YFF, YXaa₁FFY, Xaa₁FF Xaa₂Xaa₃, Xaa₁WYFF, Xaa₁F Xaa₂FF, Xaa₁Y Xaa₂FF, Xaa₁FFYXaa₂, Xaa₁FFXaa₂F, Xaa₁Xaa₂Xaa₃YY, Xaa₁Xaa₂Xaa₃FF, Xaa₁FYWF, Xaa₁Xaa₂FYY, Xaa₁YYFY, Xaa₁FYXaa₂Y, WXaa₁FFF, Xaa₁FFFXaa₂, Xaa₁YYYY, FXaa₁WFF, WXaa₁FWXaa₂, WFXaa₁FXaa₂, FWXaa₁FF, FXaa₁FFY, Xaa₁Xaa₂WXaa₃Y, FFWXaa₁Y, FXaa₁Wxaa₂Xaa₃, YYXaa₁YY, FFFXaa₁F, YFYFXaa₁, YWXaa₁FF, WXaa₁Yxaa₂F, WXaa₁YFXaa₂, WXaa₁FFXaa₂, FFFXaa₁W, FWFXaa₁Xaa₂, FYXaa₁YF, FWXaa₁Xaa₂Xaa₃, FXaa₁YYW, FXaa₁YYXaa₂, FWXaa₁WY, FFWYW, FXaa₁Xaa₂FXaa₃, FYWXaa₁Y, FYWXaa₁W, FXaa₁YFXaa₂, FWWYF, FYYYYXaa₁ and FFXaa₁WW wherein Xaa₁, Xaa₂, and Xaa₃ are amino acids of the D- or L- configuration independently selected from the group consisting of D, E, K, R, H, N, Q, C, S, T, G, A, V, L, I, M, and P.
4. The D-peptide of claim 3, wherein the core pentapeptide is selected from the group consisting of GYYFF, GFYFF, GYFFF, GFFYF, GYFFY, GYFYF, AFFFF, AFYYF, AFFYF, FAFFF, YFAFF, GFWGY, GFGWY, GAFFW, GFFFY, AFYFF, AFFFY, FFFFG, YAYFF, YAFFY, GFFGA, GWYFF, GFGFF, GYGFF, GFFYG, GFFGF, AAGYY, AAAFF, GFYWF, GGFYY, GYYFY, AFYAY, WAFFF, GFFFA, AYYYY, FAWFF, WAFWA, YGYYA, WFAFA, AFFFA, FWAFF, FAFFY, GAWAY, FFWGY, FAWGA, YYAYY, FFFAF, YFYFA, YWAFF, FFFGW, FWFGA, FYGYF, FWAAA, FAYYW,

FGYYG, FWAWS, FFWYW, FAAFG, FYWAY, FYWGW, FAYFG, FYYYYA, FWGFF, and FFAWW.

5. A library comprising a plurality of D-peptides, wherein each D-peptide comprises from three to seven D-amino acid residues, wherein at least 25% of the D-peptides comprise at least three amino acid residues independently selected from the group consisting of D-tryptophan, D-tyrosine, and D-phenylalanine.

6. The library of claim 5, wherein at least 50% of the D-peptides comprise at least three amino acid residues independently selected from the group consisting of D-tryptophan, D-tyrosine, and D-phenylalanine.

7. A library according to claim 5, wherein the library comprises at least five D-peptides.

8. A library according to claim 5, wherein the library comprises at least ten D-peptides.

9. A library according to claim 5, wherein the library comprises at least fifty D-peptides.

10. A method for identifying a D-peptide having the ability to bind to a pre-selected protein comprising contacting the protein with a library of D-peptides according to claim 5, detecting binding of the protein to a D-peptide, and identifying the D-peptide.

11. A method for making a D-peptide that binds to a pre-selected protein, comprising contacting the library of claim 5 with the protein, detecting binding of the protein to a D-peptide, identifying the D-peptide, and synthesizing the D-peptide.

12. A method for reducing the toxicity of a toxin in a mammal exposed to the toxin comprising delivering to the mammal a D-peptide that binds to the toxin in an amount effective to reduce toxicity, wherein the D-peptide comprises from three to seven D-amino acid residues, wherein at least two of the D-amino residues are independently selected from the group consisting of D-phenylalanine, D-tryptophan, and D-tyrosine.

13. The method of claim 12, wherein the D-peptide is identified according to the method of claim 10.

14. The method of claim 12, wherein the toxin is selected from the group consisting of botulinum toxins, ricin toxins, cholera toxins, and anthrax toxins or toxin subcomponents.

15. The method of claim 12, wherein the toxin is BoNT/A and the D-peptide comprises a pentapeptide core sequence selected from the group consisting of Xaa₁YFFF, Xaa₁FFYF, Xaa₁YFFY, Xaa₁YFYF, Xaa₁FFFF, Xaa₁FYYF, Xaa₁FFYF, FXaa₁FFF, YFXaa₁FF, wherein Xaa₁ is an amino acid of the D- or L-configuration selected from the group consisting of D, E, K, R, H, N, Q, C, S, T, G, A, V, L, I, M, and P.

16. The method of claim 15, wherein the toxin is BoNT/A and the D-peptide comprises a pentapeptide core sequence selected from the group consisting of GYFFF, GFFYF, GYFFY, GYFYF, AFFFF, AFYYF, AFFYF, FAFFF, and YFAFF.

17. The method of claim 12, wherein the toxin is BoNT/B and the D-peptide comprises a pentapeptide core sequence selected from the group consisting of Xaa₁FWXaa₂Y, Xaa₁FXaa₂WY, Xaa₁Xaa₂FFW, Xaa₁FFFY, Xaa₁FYFF, Xaa₁FYFF, Xaa₁FFFY, FFFFXaa₁, YXaa₁YFF, and YXaa₁FFY, wherein Xaa₁ and Xaa₂ are amino acids of the D- or L-configuration selected from the group consisting of D, E, K, R, H, N, Q, C, S, T, G, A, V, L, I, M,.

18. The method of claim 17, wherein the D-peptide comprises a pentapeptide core sequence selected from the group consisting of GFWGY, GFGWY, GAFFW, GFFFY, GFYFF, AFYFF, AFFFY, FFFFG, YAYFF, and YAFFY.

19. The method of claim 12, wherein the toxin is BoNT/E and the D-peptide comprises a pentapeptide core sequence selected from the group consisting of Xaa₁FF Xaa₂Xaa₃ and Xaa₁WYFF, wherein Xaa₁, Xaa₂, and Xaa₃ are amino acids of the D- or L-configuration independently selected from the group consisting of D, E, K, R, H, N, Q, S, T, G, A, V, L, I, M, and P.

20. The method of claim 19, wherein the D-peptide comprises a pentapeptide core sequence selected from the group consisting of GFFGA and GWYFF.

21. The method of claim 12, wherein the toxin is BotB complex and the D-peptide comprises a pentapeptide core sequence selected from the group consisting of Xaa₁FXaa₂FF, Xaa₁YXaa₂FF, Xaa₁FFYXaa₂, Xaa₁FFXaa₂F, Xaa₁Xaa₂Xaa₃YY, and Xaa₁Xaa₂Xaa₃FF

wherein Xaa₁, Xaa₂, and Xaa₃ are amino acids of the D- or L-configuration independently selected from the group consisting of D, E, K, R, H, N, Q, C, S, T, G, A, V, L, I, M, and P.

22. The method of claim 21, wherein the D-peptide comprises a pentapeptide core sequence selected from the group consisting of GFGFF, GYGFF, GFFYG, GFFGF, AAGYY, and AAAFF.

23. The method of claim 12, wherein the toxin is RCA60 and the D-peptide comprises a pentapeptide core sequence selected from the group consisting of Xaa₁FYWF, Xaa₁Xaa₂FYY, Xaa₁YYFY, Xaa₁FYFF, Xaa₁YFFF, Xaa₁FYXaa₂Y, Xaa₁FYYF and WXaa₁FFF, wherein Xaa₁ and Xaa₂ are amino acids of the D- or L-configuration independently selected from the group consisting of D, E, K, R, H, N, Q, C, S, T, G, A, V, L, I, M, and P.

24. The method of claim 23, wherein the D-peptide comprises a pentapeptide core sequence selected from the group consisting of GFYWY, GGFYY, GYYFY, GYFFY, GYFFY, AFYAY, AFYYF and WAFFF.

25. The method of claim 12, wherein the toxin is RCA120 and the D-peptide comprises a pentapeptide core sequence selected from the group consisting of Xaa₁FFFXaa₂ and Xaa₁YYYY, wherein Xaa₁ and Xaa₂ are amino acids of the D- or L-configuration independently selected from the group consisting of D, E, K, R, H, N, Q, S, T, G, A, V, L, I, M, and P.

26. The method of claim 25, wherein the D-peptide comprises a pentapeptide core sequence selected from the group consisting of GFFFA and AYYYY.

27. The method of claim 12, wherein the toxin is cholera toxin and the D-peptide comprises a pentapeptide core sequence selected from the group consisting of FXaa₁WFF and WXaa₁FW Xaa₂, wherein Xaa₁ and Xaa₂ are amino acids of the D- or L-configuration independently selected from the group consisting of D, E, K, R, H, N, Q, C, S, T, G, A, V, L, I, M and P.

28. The method of claim 27, wherein the D-peptide comprises a pentapeptide core sequence selected from the group consisting of FAWFF and WAFWA.

29. The method of claim 12, wherein the toxin is anthrax protective antigen and the D-peptide comprises a pentapeptide core sequence selected from the group consisting of YGYYA and WFXaa₁FXaa₂ wherein Xaa₁ and Xaa₂ are amino acids of the D- or L-configuration independently selected from the group consisting of D, E, K, R, H, N, Q, C, S, T, G, A, V, L, I, M and P.

30. The method of claim 29, wherein the D-peptide comprises a pentapeptide core sequence selected from the group consisting of YGYYA and WFAFG.

31. A method of reducing the ConA lectin binding to at least one of its receptors comprising delivering to the mammal a D-peptide comprising a pentapeptide core selected from the group consisting of Xaa₁YYFF and Xaa₁FYFF wherein Xaa₁ is an amino acid of the D- or L-configuration independently selected from the group consisting of D, E, K, R, H, N, Q, C, S, T, G, A, V, L, I, M and P.

32. The method of claim 31, wherein each D-peptide comprises a pentapeptide core sequence selected from a group consisting of GYYFF and GFYFF.

33. A method of reducing binding of GS1-B4 lectin to a GS1-B4 receptor comprising delivering to the mammal a D-peptide comprising a pentapeptide core sequence selected from the group consisting of Xaa₁FYYF, Xaa₁FFFXaa₂, FWXaa₁FF and FXaa₁FFY wherein Xaa₁ and Xaa₂ are amino acids of the D- or L-configuration independently selected from the group consisting of D, E, K, R, H, N, Q, C, S, T, G, A, V, L, I, M and P.

34. The method of claim 33, wherein the D-peptide comprises a pentapeptide core sequence selected from a group consisting of AFYYF, AFFFA, FWAFF and FAFFY.

35. A method of reducing binding of an anti- α Gal antibody to an α Gal epitope comprising delivering to the mammal a D-peptide comprising a pentapeptide core selected from the group consisting of Xaa₁Xaa₂WXaa₃Y, FFWXaa₁Y and FXaa₁WXaa₂Xaa₃ wherein Xaa₁, Xaa₂ and Xaa₃ are amino acids of the D- or L-configuration independently selected from the group consisting of D, E, K, R, H, N, Q, C, S, T, G, A, V, L, I, M and P.

36. The method of claim 35, wherein the D-peptide comprises a pentapeptide core sequence selected from the group GAWAY, FFWGY and FAWGA.

37. A method of reducing inhibiting anti-Ley/H antibody binding to an Ley/H epitope comprising delivering to the mammal a D-peptide comprising a pentapeptide core selected from the group consisting of YYXaa₁YY wherein Xaa₁ is independently selected from a group consisting of D, E, K, R, H, N, Q, C, S, T, G, A, V, L, I, M and P, the latter amino acids being of D- or L-configuration.

38 The method of claim 37, wherein the D-peptide comprises a pentapeptide core sequence selected from the group consisting of YYAYY.

39. A method of reducing binding of TNF α to a TNF α receptor comprising delivering to the mammal a D-peptide comprising a pentapeptide core selected from the group consisting of FFFXaa₁F, YFXaa₁FF, YFYFXaa₁, YWXaa₁FF, WXaa₁YXaa₂F, WXaa₁YFXaa₂ and WXaa₁FFXaa₂ wherein Xaa₁ and Xaa₂ are amino acids of the D- or L-configuration independently selected from the group consisting of D, E, K, R, H, N, Q, C, S, T, G, A, V, L, I, M and P.

40. The method of claim 39, wherein the D-peptide comprises a pentapeptide core sequence selected from the group consisting of FFFAF, YFAFF, YFYFA, YWAFF, WGYAF, WGYFA and WAFFA.

41. A method of reducing the binding of TGF β 1 to a TNF β 1 receptor comprising delivering to the mammal a D-peptide comprising a pentapeptide core selected from the group consisting of FFFXaa₁W, FWFXaa₁Xaa₂, FYXaa₁YF, FWXaa₁Xaa₂Xaa₃, FXaa₁YYW, FXaa₁YYXaa₂, FWXaa₁WY, FFWYW, FXaa₁Xaa₂FXaa₃, FYWXaa₁Y, FYWXaa₁W, FXaa₁YFXaa₂, FYYYYXaa₁, FWXaa₁FF and FFXaa₁WW wherein Xaa₁, Xaa₂ and Xaa₃ are amino acids of the D- or L-configuration independently selected from the group consisting of D, E, K, R, H, N, Q, C, S, T, G, A, V, L, I, M and P.

42. The method of claim 41, wherein the D-peptide comprises pentapeptide core sequence selected from the group consisting of FFFGW, FWFGA, FYGYF, FWAAA, FAYYW, FGYYG, FWAHY, FFWYW, FAAFG, FYWAY, FYWGW, FAYFG, FYYYYA, FWGFF and FFAWW.

43. The library of claim 5, wherein each D-peptide is attached to a solid support.

44. The library of claim 31, wherein the solid support is attached to a bead.

45. The library of claim 31, wherein each peptide is attached to a microtiter plate.